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The British South Africa Company

INCORPORATED IN ENGLAND

Report on Sleeping Sickness
in Northern Rhodesia

February, 1912

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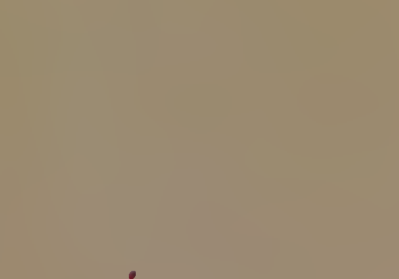
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The British South Africa Company,

Administration of Northern Rhodesia.

Report on Sleeping Sickness
in Northern Rhodesia

to

February, 1912.

No. 3.

BY

A. MAY, M.D.,

Principal Medical Officer, Northern Rhodesia

Livingstone :

Printed at the "Administration Press,"

Northern Rhodesia.

1912.

TANGANYIKA DIVISION. DR. C. W. BREEKS.

Glossina Palpalis.

The distribution of this species has not appreciably altered since the date of my last report.

It was at one time feared that extension was taking place up stream on the Lovu River. This however does not seem to have occurred. The limit still remaining a few miles north of the crossing of the Katwe-Mporokoso Road.

Segregation Camp.

Now under treatment.	Admitted.	Discharged.	Died.
	1911	1911	1911
9	—	—	4

The only cases discovered during the year were two in natives entering the territory from Mulilo's villages in the Congo Free State. These were sent back under escort and the Belgian authorities notified.

Examination of Villages.

The Lovu and Lamzua River villages have been examined with negative results.

Movements of Villages.

Arrangements have been made for the removal of the following villages.

Ngombesazi	to	Kalo plain.
Chiteku	..	near Goma-Goma village.
Kaulwe	..	.. ..
Fundi Amadi	..	L.M.S. ground near Kambole.
Kapafi	..	near Chiperipiri.
Mwalinumanga	..	Telekas villige.
Namkolo	..	?

Clearings.

Clearing is still used as a preventive measure in all the Lovu crossings.

With the exception of Traffic with the Congo, which still exists, notably with Mulilo's villages and across the Lovu, and the smuggling by Abdulla's people who are reported to still run large caravans across the Lake into German Territory, the situation as regards the prevention of the spread of the disease in this division is eminently satisfactory.

MWERU AND KAWAMBWA DIVISION.—DR. D. C. MASTER.

Gl. Palpalis Distribution.

No change is reported as having taken place in the distribution of this fly since the date of my last report.

Movements of Villages.

As reported last year some 11,000—12,000 people were moved from the neighbourhood of the Luapula on to Mofwe. These, Dr. Master now reports as self supporting. The ground in the neighbourhood of the new villages being very fertile and the crops, including rice, doing excellently. Dr. Master also reports that the Chienji movement has been a complete success. The people complain very little. A large supply of seed has been given to them, and food in the surrounding villages is fairly plentiful.

In addition to these movements all the Northern Border people have now been removed and placed on a strip of land running along the Kalungwisi between Nkosya and the Kundawika Falls.

Chiwonda's village has been moved from Lake Mweru to close to Mswala.

Mulwi's village, in the neighbourhood of which Gl. Fusca has been found has also been moved.

It is recommended that Kalembe's and Muakunta's villages, which have amalgamated should be moved during next dry season.

Palpation and Examination of Villages.

The Northern Border villages were palpated during February and March when a gland index of 29.3 and two cases of the disease were found. These were repalpated at the time of their removal in June with the following results.

Palpation of North Border Villages During Movement.

Name.	No. exam'd.	AA	or vice-versa				Total glands.	Index.
			BB	AB	AO	BO		
Musoma	147	4	3	12	5	4	28	19.1
Chipungu	344	8	11	9	23	32	86	25.0
Kasembe	239	6	4	7	14	17	48	20.08
Mwabo	153	4	0	5	16	16	41	26.7
Mumpuya	90	2	2	2	3	10	19	21.1
Chitunga	31	0	2	0	0	6	8	25.7
Matipa	40	1	1	0	3	5	10	25.0
Totals	1044	25	26	35	64	90	240	

Gland Code.

AA	...	...	Ambilateral aspirable.
BB	...	...	.. nonaspirable.
AB	...	...	One side aspirable, other not.
AO	...	...	One side aspirable, other absent.
BO	...	...	One nonaspirable, other absent.

Right side stated first.

All AA glands were punctured.

Trypanosomes were found in the case of Kabwe, female, of Chipungu.

Classification.

The above gland code is that advocated by Dr. Master, and is based on the assumption that no ambiguity will arise as to whether or not any given gland is aspirable, and is certainly one into which, provided due attention be paid to unilateral aspirable glands, the personal equation does not enter to such an extent as it does into the present almost universally adopted method of classification, and which with the elimination as far as possible of the personal element is more likely to provide a fuller knowledge as far as the system of gland examination is applicable.

Spread of the Disease.

There is no obvious increase of Sleeping Sickness in this division.

There are now no villages in dangerous situations remaining on the Lake shore.

At the Fort Rosebery Conference in July of last year the question of the opening up of the Southern part of this division was fully discussed. In view of the present satisfactory position it is now recommended that this should be done.

Segregation Camps.

There are still two Segregation Camps in this division, one at Kawambwa and one at Chienji.

Return for 1911.

Now under treatment.		Admitted.	Discharged.	Died.
		1911	1911	1911
Kawambwa	3	1	—	1
Chienji	7	2	4	—

The four cases discharged as apparently cured are under regular supervision. The three cases admitted were all from the Northern Border villages.

only one other case of the disease was found. This native was returned to Mpweto, (Congo Belge) from where he had recently come.

Conference with Belgian Officials.

Mr. Lyons and Dr. Master met the local Belgian officials at Mpweto in July and discussed and arranged for co-operation in the removal of the Northern Border and Sumaili's and Chiwonda's villages.

FORT ROSEBERY DIVISION.—DR. W. H. T. STORRS AND DR. A. F. WALLACE.

Gl. Palpalis.

Some changes have taken place in the distribution of the fly since the date of my last report.

1. Dr. Wallace found during January and February that *Palpalis* had spread up the Luafumu. The fly extending from the Luapula for about nine miles to half way between the villages of Sera and Kapakera. The Luafumu did not carry fly in October 1910.

2. During August and September Dr. Storrs examined the Mansa and Luapula Rivers to Kapwepwe and he reports as follows:

"Apparently the actual fly limit does not vary much (on the Mansa) whatever the season, though fly is much more scarce during the dry season. *Palpalis* extended up the Lumanwa for about six miles and is now within a couple of miles of Chansas fishing village" (Both this village and Kasombe's have since been moved.)

3. Dr. Storrs after a careful search failed to find *Palpalis* on the Luapula south of the Mansa mouth. It will be remembered that *Palpalis* formerly extended up stream to near Kapwepwes some fifty miles south of this, which fact taken in conjunction with the recent movement of villages from the vicinity of the river and Dr. Wallace's report of the extension of fly up stream on the Luafumu may serve as an indication that these fly move in search of food and points to a possibility of successfully dealing with this species by the removal of their food supplies, before however the observation becomes of any value further observations will have to be made as to any recent changes on the Belgian bank of the river which might have influenced this, and also as to the presence or absence of game on both banks. There is also the possibility that the change may be purely seasonal. No such change has been observed to follow the movement of villages from the shores of Lake Tanganyika, where however game is fairly plentiful, the extensions of fly on the Lovu and Lanza Rivers flowing into the Lake not apparently altering its distribution on the lake shore.

Movements of Villages.

Mr. Harrington acting in conjunction with Dr. Wallace during the earlier part of the year and afterwards with Dr. Storrs, on his return from leave, has carried out the following movements of villages.

The two groups of villages of the Chiefs Luwewi and Mwawa from the neighbourhood of the Luamfummu River to the Chilila River a tributary of the Wembe. In this connection Dr. Wallace reports "The Wembe river flows into the Luongo about one mile east of Nusambo's village. Palpalis is found on the Luongo two miles west of Musambo's; it is conceivable that fly might reach the Wembe mouth but to get to the place where it is proposed to put the Luwewi people it would have to come up stream for 14 miles and in that distance the stream rises well over 1000 feet. An examination of the stream makes it impossible to imagine it as a fly habitat."

Musunta's village was moved to the east side of the Luwembe, Chipingola and Sasara to Chisunkas.

Kasompi (of the Matanda group) from the lower Mansa to the Lukwenu River just outside the Sleeping Sickness area.

The following villages from the area below the Mansa—Chafosi clearing: Muloki, Mulonga and Mwilembo: these are now on the Vibobo River on the Fort Rosebery—Ndola Road.

Chansa, Kaimbi, and Kafudhya to the Kashia and Muombi Rivers just outside the Sleeping Sickness area.

The whole of the Kapwepwe group, consisting of the villages of Kapwepwe, Msakanya, Mutondo, Kasuuga, Kaporlwa and Chipeti have been moved from about the Lumbu River near the Luapula to the Chiswisi River near the entrance of the Lukola stream.

The Katuta group (near old Madona) consisting of the villages of the Chief Katuta and his sub villages Chiwalawala, Chikowi, Kafulila and Mlota, have been moved from their old sites, into one big village, on the Kapemba Stream which enters the Luamfummu, outside the Sleeping Sickness area. The balance of the Matanda group, consisting of the villages of the Chief Matanda and his sub villages Wadia Kamina and Mwiyaamba, have been moved to the Lukwenu stream, outside the Sleeping Sickness area. These are all in one big village.

The Mao group, consisting of the villages of the Chief Mao and his sub villages Kalukushia, Katambo, and Kanyembe, have been moved into one big village on the Muombi Stream in the clean area.

The Kundamfummu group consisting of the villages of the Chief Kundamfummu and his sub villages Masangala, Kafushiachiwamba, Mambidima, Kafushiachipompwi and Sepi, have been moved into one big village on the source of the Chiswisi, on the Sleeping Sickness boundary fully 25 miles in a direct line from the Luapula.

This completes the removal of the 8 groups considered necessary to remove from the Sleeping Sickness area, viz, Luwewi, Katuta, Mwawa, Matanda, Chansa, Mao, Kundamfummu and Kapwepwe. Mr. Harrington is also now moving to the Mpeketi—Chiswisi junction, the Kasoma group consisting of the villages of the Chief Kasoma and his sub villages Mpita,

Myembi, Mtunta, Msongo and Kinyensi. This makes a clean sweep in the Southern half of the Sleeping Sickness area.

These changes effected during the year under review by Mr. Harrington, Drs. Storrs and Wallace, together with the large movement of villages reported last year as having been carried out by Mr. Lyons and Dr. Master result in practically the movement of the whole native population from the vicinity of the Luapula and any of its tributaries which carried *Glossina Palpalis*. And it may reasonably be expected that in the near future the necessity for the present strict restrictions over this area will have ceased to exist, and with the exception of precautions to prevent the return of these natives to the Luapula these restrictions can be dispensed with.

Segregation Camp.

Established in February, 1908.

Total number of admissions 45.

Summary for 1911.

Now under treatment.	Admitted	Discharged.	Died.
	1911	1911	1911
28	6	—	3

Treatment.

No change has been made in the method reported last year.

The Belgian Congo.

In connection with co-operative measures on the west bank of the Luapula, Dr. Storrs writes "Again I must draw attention to the extraordinary attitude taken by the Belgian Authorities with regard to the closing of the Luapula: There seem to be no restrictions whatever placed on the movements of natives. Two years ago I mentioned the constant visiting of natives to this side and apparently the same conditions exist today. I have been told that each village is allowed to keep canoes and I see no reason to disbelieve the statement judging by the number of natives I saw on the Congo shore. There were fish dams in use at several places notably at the mouth of the Mansa (village Chipera) between an island and the Belgian bank, and at the mouth of the Mashinini."

Palpation & Examination of Natives.

During January and February the northern part of this division was palpated by Dr. Wallace, no cases of trypanosomiasis were found, the southern part was examined during February and March with negative results.

Cases of Trypanosomiasis Admitted During 1911.

Two from Chikwawa's (Congo-Belge). During June Chikwawa, the

headman of a small village of the Katata group who had crossed the Luapula into Congo Territory when these villages were first moved away from the river in 1908 returned and asked permission to reside again in this area. Dr. Storrs found 3 cases of Trypanosomiasis among these natives.

(Since this was written Palpalis have been found (March, 1912) at Chinamas south of Madona. The stretch of River to Kapwepwes on the south is now being re-examined by Dr. Storrs).

BROKEN HILL SEGREGATION CAMP.—DR. D. S. MACKNIGHT.

From November, 1910—January, 1912 no new cases of Trypanosomiasis were found at Broken Hill. This may be largely attributed to the efficiency of the Luangwa closed area regulations.

In July, 1911, the two remaining patients were discharged and the camp closed.

Dr. MacKnight reports as follows:—

While the camp was open only one case of S.S. was returned to us from S. Rhodesia. This native (Mpetaluka) had gone south of his own accord and had not been examined medically before he left Northern Rhodesia. This case has never shewn any sign of disease here, nor has he had any treatment. Two other cases in both of whom I found Trypanosomes once only, have never shown Tryps. again, have had no treatment, yet have remained perfectly well. Either spontaneous cures occur or the Trypanosomes seen were not those of Sleeping Sickness. The chances of Sleeping Sickness developing in these cases later seems very remote.

Attached is a list giving the further history of the six patients who were in camp on November 30th, 1910.

Name.	Date of admission.	Showed Tryps. last.	Results.	Examined. Feb. 1912.
Ndebwera.	Sept., 1909.	Feb., 1910.	Discharged Jan., 1911.	Perfectly well.
Alefen.	Sept., 1909.	Jan., 1911.	Died Jan., 1911.	
Rupia.	Sept., 1909.	July., 1911.	Died July, 1911.	
Jambo.	Oct., 1909.	Dec., 1910.	Died Dec., 1910.	
Kalunga.	Nov., 1909.	Oct., 1910.	Discharged July, 1911.	Perfectly well.
Mpetalnka.	Sept., 1910.	None.	Discharged July, 1911.	Perfectly well.

Remarks. In all the three fatal cases death occurred in the typical somnolent state. Each case was weighed every month and it is very interesting to note that up to a month before death each of the three patients increased in weight. There was no oedema and increase in weight was due to subcutaneous fat. During the last stage it was impossible to weigh the patients but they evidently lost weight rapidly.

Name.	When admitted.	About a month before death.
Alefen,	103 lbs.	116 lbs.
Rupia,	88 lbs.	123 lbs.
Jambo,	94 lbs.	112 lbs.

I am informed that Chisako and Nandwe who were discharged in February, 1910 are well. These are the two cases in whose glands trypanosomes were found once only.

OCCURENCE OF CASES OF HUMAN TRYPANOSOMIASIS OUTSIDE KNOWN ENDEMIC AREAS AND IN THE ABSENCE OF GLOSSINA PALPALIS.

As previously reported twenty eight cases of the disease had been found in the Luangwa Valley up to the end of November, 1910, at which time an active search was being conducted for the presence of *Glossina Palpalis* both on the Luangwa and Zambesi Rivers and their tributaries. These searches having proved negative, and it is becoming evident that *Glossina Palpalis* was not to be held responsible for these infections, a Commission was appointed with the primary object of carrying out investigations as to the transmitter of the disease.

Luangwa Valley Sleeping Sickness Commission.

As first constituted this Commission consisted of Dr. Allan Kinghorn, of the Liverpool School of Tropical Medicine and the West African Medical Staff as Chief Investigator, (Dr. Kinghorn had previously, with Mr. Montgomery in 1907—1908, under the auspices of the Liverpool School been in charge of similar investigations on Lake Tanganyika and elsewhere in Northern Rhodesia), Dr. H. Leach of the Northern Rhodesia Medical service, an Entomologist and a Bacteriologist.

Shortly after Dr. Kinghorn's arrival in the Luangwa Valley, Dr. Leach was granted sick leave. He was replaced by Dr. A. F. Wallace of this service. Mr. Ll. Lloyd formerly Curator of the Sheffield University Museum replaced Mr. O. C. Silverlock who was drowned while examining the

Zambesi for *Glossina Palpalis*. Later Dr. Warrington Yorke of the Runcorn Research Laboratories joined the Commission.

Nawalia, on the Nyamadzi River a tributary of the Luangwa, was selected as the site for the headquarters of the Commission. This station is on the Mpika—Fort Jameson Road about 40 miles to the east of the Muchinga Escarpment, and about 14 from the Luangwa River, E. 32.2 12.4 S. The altitude of the laboratory site is roughly 2,100 feet.

Summary of Sleeping Sickness Commission's Results.

Work was started here in June of last year.

The following is Dr. Kinghorn's summary of the results obtained up to the time of writing the paper previously referred to, i.e. January, 1912.

1. The human trypanosome in the Luangwa valley is transmitted by *Glossina Morsitans* (westw.).

2. Approximately 5 per cent. (4.76) of the flies may become permanently infected and capable of transmitting the virus.

3. The period which elapses between the infecting feed of the flies and the date on which they become infective is approximately 14 days.

4. An infected fly retains the power of transmitting the disease during its life, and is infective at each meal.

5. Mechanical transmission does not occur if a period of twenty-four hours has elapsed since the infecting meal.

6. Some evidence exists to show that in the interval between the *Infecting* feed and the date on which transmission becomes possible the parasites found in the flies are non-infective.

7. *Glossina Morsitans* in nature has been found to transmit the human trypanosome.

8. Certain species of buck, viz. Waterbuck, Hartebeeste, Mpala and Warthog have been found to be infected with the human trypanosome.

9. A native dog has been found to be infected with the Human Trypanosome.

This summary shows that the object which determined the formation of this Commission has been accomplished, and *Glossina Morsitans* has been incriminated as the transmitter of the disease both in nature and under laboratory conditions. In addition to which it has been found that certain animals can act as the hosts of this virus, without suffering thereby, and that the trypanosome has a wide distribution in nature.

Plateau Transmission Work.

A similar series of experiments with the object of determining whether *Glossina Morsitans* has similar transmitting powers under the somewhat different climatic conditions which exist on the Muchinga Plateau, will be carried out during the coming months. The results of which may I think safely be taken to represent what may be expected in this connection

throughout the rest of the territory, and this in conjunction with the results already obtained should settle the question for all African Colonies.

Palpalis and T. Gambiense Experiments.

Owing to a series of unfortunate failures in attempts to procure the pupae of *Glossina Palpalis* and transmit them to Nawalia (from the Luapula), and owing to the difficulties of transport of the *T. Gambiense* Strain, a comparison between these have not yet been found possible, namely the transmission power of *Glossina Palpalis* for the Luangwa Valley human trypanosome, and conversely that of *Glossina Morsitans* for *T. Gambiense*, it is hoped however that it will be possible to complete both these experiments during the next few months.

Identity of the Luangwa Valley Human Trypanosome.

Drs. Stephens and Fantham of the Liverpool School of Tropical Medicine have advanced the idea that the Luangwa Valley trypanosome and also the Nyasaland trypanosome is a new species, and have called it the *T. Rhodesiense*. A peculiar morphological condition namely a posterior position of the nucleus is the point on which they base their claims for this. In addition to this they found many points of difference in virulence, incubation period, and clinical course in making comparison of the animal reactions of this and a known strain of *T. Gambiense*; a point however which should not be overlooked in considering these results is the fact that in dealing with the Luangwa variety they were dealing with a strain which had recently been obtained from a human source, whereas in the *T. Gambiense* experiments they were dealing with a strain which had apparently been for a very considerable time kept going under laboratory conditions and by means of experimental animals, a circumstance which in all probability may have introduced considerable modifications into its virulence as well as possibly into its morphology.

There are at least three possibilities as to the identity of the Luangwa Valley Human Trypanosome it may be (a) a modified *Gambiense*, (b) a modified animal trypanosome, (c) a new species.

The two latter of these possibilities can only be dealt with by experiment, crossed inoculations, &c. In connection with the former there are however some points apart from actual experiment that may have a bearing on the question of identity. They are (1) the great majority of the cases of human trypanosomiasis found in, or attributable to, the Luangwa closed area have been on or close to four main routes, namely the Mpika—Fort Jameson road, the Broken Hill—Fort Jameson road, the Luangwa River and a route on which there was until the present restrictions came into force a considerable amount of traffic, namely from Nyasaland through Chimunda's country and village into North-Eastern Rhodesia. The first three of these routes were considerably used before the closure of the Luapula and Tanganyika areas in 1907, by natives of these areas either travelling south in search of work or when employed in transport, &c.

The fact that a preponderance of the disease has up to the present been found on, or in proximity to, the main traffic routes from a known

Gambiense endemic area is a point in favour of a close relationship between the two infections. The fact that there is a different intermediate host, and certain differences in morphology and virulence, can possibly be accounted for by the adaptation of the organism to its surroundings.

The following is the more important work which now remains to be done by this Commission.

1. Further study of Game and Domestic animal Trypanosomiasis.
2. Plateau transmission work.
3. Experiments as to the transmitting power of other blood-sucking insects, e.g. ticks, floor maggots, mosquitoes, tabanids, stomoxys, &c.
4. The identity of the trypanosome.

THE LUANGWA VALLEY SLEEPING SICKNESS AREA.

This area is roughly that part of Northern Rhodesia which lies between the Muchinga range on the west and the Nyasaland Border on the East; The Southern Boundary is that of Northern Rhodesia, namely Portuguese Territory. For convenience it has been called the Luangwa Valley area, the name however is misleading in that the area comprises more than this name implies, namely that part to the East of the Luangwa and between the actual valley and Nyasaland. It includes the Fort Jameson, Petauke and Lundazi districts and those parts of the Serenje, Mpika and Chinsali districts which lie at the foot of the Muchingas.

This was defined as an infected area under Government Notice 24 of 1910, and rules as to entry and exit, routes to be travelled, employment of carriers, recruitment of labour &c., were published in the North-Eastern Rhodesia *Gazette* of December 15th 1910.

HISTORY OF THE DISEASE IN THE LUANGWA VALLEY.

The diagnosis of Trypanosomiasis at Broken Hill in August 1909 in the case of a European who had recently travelled to that place from Fort Jameson via Petauke and Chutikas (Hargreaves) was the first indication that infection was possible in this territory outside the known *Glossina Palpalis* areas. (There were previous to this two cases of the disease in Nyasaland natives who had travelled from that country through the present closed area: it is doubtful where these infections were contracted).

Steps were immediately taken to have the Luangwa River and its tributaries searched for the presence of *Glossina Palpalis* and the neighbouring area for the presence of further evidence of the disease, which resulted at the end of 1910, eighteen months after suspicion was first aroused, in the failure to find evidence of the presence of *Glossina Palpalis* and in the discovery of a further twenty-seven cases of the disease (Report 1910).

In the absence of *Glossina Palpalis*, *Glossina Morsitans* or *Fusca* seemed the most likely alternative and early in 1911 a Commission was formed

to carry out investigations as to the transmitter of the disease, these as elsewhere reported have resulted in the incrimination of *Glossina Morsitans*.

No satisfactory conclusion can be arrived at as to the probable date of the introduction of or the commencement of the disease in the Luangwa Valley.

In June 1907 a native of the Chinsali district was found by Dr. Chisholm to be suffering from Trypanosomiasis; this native died at Mwenzo in July 1907. An inquiry was held into the circumstances of this case, and presumably the infection was at that time attributed to the Luapula. Mr. C. McKinnon who held the inquiry has recently informed me that the evidence was then by no means clear that this native had ever been sufficiently near to the Luapula to have contracted the disease through the agency of *Glossina Palpalis*. His village was situated in a morsitans belt bordering on the northern part of the Luangwa Valley. As a result of recent development doubt has now arisen as to whether this infection was contracted through the agency of *Glossina Palpalis* on the Luapula or whether it was not a case of the same disease as we are now dealing with in the Luangwa Valley.

Chilotera.

Many natives of the present closed area claim to have known this disease for a considerable time; *Chilotera* is one of the names by which it is said to be recognised. Mr. H. S. Thornicroft has collected a considerable amount of evidence on this subject and is inclined to favour the idea that the disease is by no means new to the southern part of the area (Petauke Division). Recently I had an opportunity while travelling with Mr. Thornicroft of hearing this disease described by the natives themselves. Their description corresponds to a remarkable extent with the later stages of Trypanosomiasis. They describe the somnolence, the slow shaky state, progressing emaciation and weakness, and finally loss of control over rectum and bladder. The first sign of the disease being evidence of impotence. This is the cardinal point on which the native diagnosis is made, women and children, they claim, cannot suffer from the disease.

In that part of the Petauke division in proximity to the Luangwa river the name seems to be well known and it is stated that the disease has existed there for a considerable time.

The name *Chilotera* is known as far north as the Mpika district, some 200 miles north of Petauke, where I was informed that it meant a disease confined to full grown men and in which impotence seemed to be the essential condition. Here owing to difficulties in interpretation I could not get any very definite information.

Dr. Kinghorn, who doubts the identity of the disease with Trypanosomiasis has found very diverse accounts of the subject amongst the Nawalia district natives.

In one case a boy of about eight years was found by him to be suffering from Trypanosomiasis; his relatives said that he had "*Chilotera*."

However on his removal to the station the natives there ridiculed the idea saying that "he was too young and not fit to marry."

In connection with two natives in the segregation camp showing well marked coma before death the local natives denied that people suffering from Chilotera exhibited this symptom.

At a village where Dr. Kinghorn found a case of Sleeping Sickness, the Chief denied all knowledge of Chilotera, and said he had never had it in his village.

In another instance the friends of a native who had the disease volunteered the information that the sick native's father had died of Chilotera some little time previously.

Nyamakazi and Mvimba:

In the Lundazi District Dr. A. F. Wallace found Chilotera was unknown amongst the great majority of the natives. Two of the cases of Trypanosomiasis found by him called their complaint 'Nyamakazi' or 'Mvimba' and Mr. H. G. Willis who collected information on this subject throughout the district states that the chief symptom of the former is impotence and that the latter name is given to many diseases.

It would appear therefore that a disease in which impotence is a prominent symptom is widely known amongst the natives of the whole Luangwa area, and that it is called by various names one of which is Chilotera, that the natives probably do recognise Trypanosomiasis in adult males but that there is no evidence to show that the disease is not a recent introduction.

EXAMINATION AND DIAGNOSIS.

The method of conducting the routine examination of the native population of the Luangwa closed area in no way differs from that adopted elsewhere, e.g., in Palpalis endemic areas (Luapula, Lakes Mweru and Tanganyika), and consists of gland palpation and puncture, with the microscopic examination of fresh preparations of gland juice and blood, and in certain cases both thick and thin blood films.

Clinical Signs.

The objective signs of most value have been found to be pyrexia, puffiness of the face and eyelids, tremor of tongue, and general shakiness, a vacant expression and slowness of movement and of speech. Variations are found both in the intensity of these conditions and in their constancy.

Little history that is of value can as a rule be obtained from natives, but dysenteric symptoms and vomiting at the commencement or early in the disease are signs of some significance.

In some few cases the disease has been already diagnosed by the patients, friends as Chilotera, a subject which is referred to elsewhere.

It is not yet possible to make a comparative estimate of any one sign or series of signs. The presence of palpable or puncturable cervical glands of certain consistency the estimate of which is only gained by experience, the appearance presented by the puffiness of the face and eyelids, tongue tremor and general shakiness and slowness, even in the absence of emaciation are very characteristic and provide grounds on which a diagnosis can sometimes be made even before microscopical evidence is found.

The facility with which a diagnosis can be made varies to some extent with the stage of the disease.

In the early stages while infection is recent, microscopic evidence alone is available. It is probable that the first evidence of the disease occurs within a week after infection has taken place and shows itself in an acute febrile attack, clinically differing in no respect from febrile attacks due to other causes, during the following periodic attacks of fever before glandular enlargement occurs, the microscopical demonstration of the trypanosomes in the blood is the only method of diagnosis; in the intervals between these periodic attacks when the patient returns to, or almost to, his normal state of health for short periods, a definite diagnosis may be difficult or almost impossible without having recourse to the inoculation of of experimental animals or other methods not often practicable.

Later, and during what may be called the second stage, when there is present some impairment of the general health with gradually increasing weakness, puffiness, shakiness, slowness, and Oedema with probably in males, if it can be obtained, a history of decreasing virility, glandular enlargement to a more or less marked extent will be found and a diagnosis will be made by gland puncture; periodic Pyrexia is an accompaniment of this stage; during these attacks trypanosomes can be found in the blood but as a rule not in so great numbers as during the attacks immediately following infection.

In the terminal stage somnolence is generally a marked feature, with debility, and implication of the nervous system, loss of control over Bladder and Rectum, and impotence—a sign of great import to the native mind and the one on which they make their diagnosis.

The disease is apparently more virulent than that occurring in palpalis areas but otherwise its clinical appearances do not seem to differ from this to any very marked extent.

Gland puncture and Blood Examination.

In comparison to gland puncture, blood examination seems of very little value. In my own experience trypanosomes are very rarely found in the peripheral circulation, except during pyrexial attacks, by the methods which can be used for the examination under the conditions which obtain in the examination of large numbers of natives in the field, and when more elaborate methods of examination are not practicable.

During pyrexial attacks and more especially during those following a recent infection trypanosomes are generally numerous in the blood.

A method of blood examination depending on the demonstration of some constant property, or product of trypanosome infection present in the blood throughout the disease, if such exist, and by which a diagnosis could be made even in the absence of trypanosomes is required.

No method of examination with the demonstration of any such quality as its object and which would be of practical use under the conditions of these examinations has as yet been demonstrated.

Auto-Agglutination.

It has been suggested that a method of demonstrating the auto-agglutination power which is present in the patients suffering from trypanosomiasis, simplified for use in the field, might meet these requirements. Microscopically the evidence of this particular property is unsatisfactory; it is not constant, and numerous fallacies, depending on the technique employed, and the proper differentiation of what is and what is not agglutination, interfere with the value of the test to such an extent as to make it almost useless.

With the object of devising a method of microscopic or naked eye recognition of this property, which would be of practical utility in field work I have recently made a short series of observations on the comparison between the blood of patients suffering from trypanosomes and of healthy natives. A simple technique, in which by reason of its simplicity few if any fallacies could occur was adopted, capillary pipettes of the type used for opsonic observations were employed; washed human blood corpuscles were mixed in these pipettes with various dilutions of the serum from the blood to be tested, and inoculated at a temperature of 20°—22° C, (the lowest obtainable under the conditions under which this work was done), and using as a control the serum of healthy individuals, for the most part Europeans. These experiments are still incomplete, but the following conclusions can be drawn from the results obtained.

Value of Auto-Agglutination in Diagnosis.

1. The presence of auto-agglutination to a well marked extent in the blood of patients suffering from trypanosomiasis.
2. The presence of this property to a more or less marked degree in a considerable proportion of the natives examined and who were free from trypanosome infection.
3. Its very well marked presence in the blood of a native who harboured *Filaria Perstans*, and in whose case there was not at the time, nor has there been since, about seven months afterwards any suspicion of infection with trypanosomes.

The phenomenon has also been described by Dr. D. C. Master as apparent in the blood of a patient suffering from *Spirillum* Fever.

It would thus seem that the property is not specific for trypanosomiasis but is also produced by other causes possibly by a protozoal infection of any sort.

For these reasons it is not considered that any test for this property in the blood will prove to be of practical value in the field.

These experiments are however being repeated on a large scale by Drs. Leach and White at the Fundu Detention Camp and it is hoped that statistics will soon be available to show whether or not the method is one of practical utility.

The arguments urged against the utility of gland palpation and puncture namely that "Infected persons have cervical glands in no way different from those of a large majority of healthy natives" seems to be a step backwards in our methods of dealing effectively with the disease; the statement as to the frequency of glandular enlargement, other than those due to trypanosome infection is undoubtedly true. The difference in the causative agent however can only be determined by gland puncture and microscopical examination. The alternative method apparently in use in Nyasaland that of the examination of films made by native assistants will probably result in the finding of a very small percentage of the infections, namely those in whose blood trypanosomes happen to be fairly numerous at the time when the films were taken.

Gland puncture is essential in the differentiation of the cause of these enlargements. This method of diagnosis, which though by no means perfect, is the best we have at present at our disposal and to neglect it will result in a very false and underestimate of the prevalence of the disease.

LUANGWA VALLEY.

Serenje District.

This was palpated in the neighbourhood of the Luangwa River by Dr. Leach during December, 1910, and January, 1911. The northern part in proximity to the two Serenje—Fort Jameson roads by Dr. Brown during August and September. No cases of the disease were found.

Petauke District.

In the neighbourhood of Hargreaves, Petauke and in proximity to the river; this has been twice palpated by Dr. Leach and once by myself. Dr. Leach found eleven cases of the disease; my examination during November and December resulted in the finding of five cases. The Southern Border Road as far as Nyanje was examined during October by Dr. Farndale with negative results. Chinunda's district was examined by Drs. Leach and Wallace, result five cases. I examined the Chinunda—Fort Jameson Road during October with negative result.

Lundazi District.

Dr. Wallace during part of November, December and January made a thorough examination of the whole Lundazi district and a part of the Fife district, 19687 people being seen—a very large proportion of the whole population. These people are rather reluctant to submit to examination and the fact that such a large proportion were seen in due to the valuable

assistance given by Mr. H. E. Willis who is in charge of the district and who accompanied Dr. Wallace throughout.

Seven cases of the disease were found. Dr. Wallace gives the following tables as the gland index.

No. glands.	Unilaterals.	X— —	X—	X
15.08.	36.11.	17.04.	1.42.	0.05.

Under the heading "Unilaterals" are only included X—glands. Any unilateral glands which were X— or X were placed among the Bilaterals.

Residence in morskans areas as compared to residence outside these areas.

In morskans areas 177 villages containing 11,484 people.

No. glands.	Unilaterals.	X— —	X—	X
44.15.	36.58.	17.49.	1.65.	0.01.

In fly free country there were 109 villages and 8203 people the gland index of which was :

No. glands.	Unilaterals.	X— —	X—	X
46.23.	36.29.	16.33.	1.09.	0.06.

From these figures Dr. Wallace concludes that residence in fly areas has no apparent influence on the incidence of enlarged glands taking it for granted that the flies are not infected with human trypanosomes.

"A marked difference was noted between different tribes. There was a distinctly higher gland index amongst the people in the Fife district who were at least 40 miles from the nearest fly as compared with the Angoni near Lundazi Boma whose villages were either amongst fly or bordering on it."

"There were several villages in the north end of the Lundazi district to which the fly had only spread this year. It had been there previous to the rinderpest."

Account was kept of the domestic stock in the villages.

Morsitans country.			Fly free country.
Goats.	368.	...	612.
Sheeep.	229.	...	513.
Dogs.	238.	...	479.
Cattle.	19.	...	498.
Pigs.	—	...	26.

“At Sumaili's village, on the Fort Jameson—Lundazi Road a sick dog was found. Its blood showed trypanosomes, two to one films were made and a rat inoculated and sent to Nawalia where the dog was found to have been infected with the human trypanosome.”

GLOSSINA MORSITANS (LUANGWA CLOSED AREA).

Distribution.

No accurate mapping of the distribution of this species has as yet been done. The infested areas are however roughly known.

Chinsali District.

Fly is present but not numerous throughout the southern part.

Mpika District.

Fly was met with in numbers in almost every part of this district traversed during September, 1911.

Serenje District.

A small area between the foot of the Muchingas amongst the foot hills is apparently fly free, elsewhere fly seems to be numerous. Dr. A. Brown reports that on the Serenje to Fort Jameson road via Chewandas fly exists from the Muchingas on the west to a few miles beyond Kawatas on the east of the Luangwa; from this point to Fort Jameson no fly were seen.

A route north of this road formerly used as a cattle road is now reported by Dr. Brown as being infested.

Petauke Division.

Fly is plentiful along the Luangwa River as far south as Nyalugwe's village. It is very numerous for some distance along the Lukasashi River bordering this division; it exists more or less constantly along the Chutika—Petauke—Sasare Road starting eight or ten miles to the west of the River.

Fly can be found in the neighbourhood of the Petauke Boma but is not plentiful. South of Petauke and between there and the southern border road there is a large fly free area the limitations of which are however not at present known.

Fort Jameson District.

South of Fort Jameson to the Portuguese border is fly free. On the southern border road fly are found near Nyanje in small numbers, and between Kanduzus and Sitchitambo's village. From about 10 miles north of Fort Jameson fly in varying numbers exists almost continuously to Chinundas and the northern border of the district.

Lundazi District.

An account of the distribution and spread of *Glossina Morsitans* in this district, by Mr. P. E. Hall appears in the Bulletin of Entomological Research Vol. 1. part 3. A later map by Mr. H. G. Willis shows two small fly free areas in the district namely:—

1. A narrow strip varying from ten to twenty miles wide running north and south along the Nyasaland Border from some ten miles South of the Lundazi River on the South, to a similar distance South of the Luwumbu River on the North, a distance of approximately 120 Miles.

2. A small area bordering on the Luangwa River and bounded on the north by the Kamimbe stream and including Mulilos, Chikuntas, Chipenges and Mulengas villages.

The following notes by Mr. Ll. Lloyd, Entomologist to the Luangwa Sleeping Sickness Commission, made during a journey in this district can be taken as an example of the distribution of the fly generally throughout the area.

Glossina.

The only species seen was *G. Morsitans*. No part of the country traversed is very badly infested with this fly at present. The gardens of the big villages such as Munda and Kambwiri seem to be free, but Popoma was an exception to this.

Nawalia.

Nawalia. To the Luangwa (Kasongo), moderately numerous but in the immediate neighbourhood of the river none could be found.

Kasongo. To Mlambe, fly seen everyday but in small numbers, one or two only.

Munda. To Chinunda, fly rather numerous all the way, at Popoma bad.

Bramburi. To Chuosi, one or two seen.

Mundaoka. To Kawaza, a little fly all the way.

Kawaza. To Ntanta none seen, this section includes the crossing of the Luangwa, and about four miles of its banks.

Ntanta. To Nawalia none; to Mperembe rather bad.

In the section where fly are most numerous, Munda to Chinunda, there are no domestic animals with the exception of one dog at Pandamanga, which was found to have Trypanosomiasis. The number of domestic animals seems to be in inverse proportion to the amount of fly.

Where game was most numerous around the Luangwa there was no fly.

GLOSSINA MORSITANS.—SPREAD & C.

There is little doubt that the extent of country infested with this fly is now very much greater than it was a few years ago, numerous instances could be given of its existence now where formerly it was absent.

Mr. P. E. Hall has described its spread in a paper previously referred to.

Mr. Thornicroft remembers the existence of a large herd of cattle at Hargreaves eight or nine years ago, he does not state definitely that fly was not then present there, but at least it did not then prevent cattle being kept. It was possibly present in small numbers, and not infected. It is now in great abundance at this place.

Kambwiris, on the Nawalia—Fort Jameson Road two or three years ago was fly free and large herds of Government cattle were kept there. Fly were fairly numerous there when I visited the place in October last. There is also the instance reported by Dr. Wallace of the recurrence of fly in the neighbourhood of villages which had been free since the rinderpest. There are many other similar instances.

These appear to be instances of actual spread and not only movement. There is no corresponding freedom of areas formerly infested.

The following is furnished by Mr. Lloyd and gives the results of the breeding of *Glossina Morsitans* at Nawalia to the middle of December:—

Date.	No. of pupae, app. healthy obtained.	No. of these pupae which "hatched."	No. of these pupae which died.	Ay. duration of pupation period.	Mean temp. in laboratory.
June, 27-30	3.	3.	0.	51 days.	
July 1-15	6.	5.	1.	46 ..	64.09.
16-31	25.	18.	7.	38.7 ..	68.33.
Aug. 1-15	9?	9.	0?	35.2 ..	69.42.
16-31	1?	1.		33 ..	73.01.
Sept. 1-15	—	—	—	—	72.69.
16-30	15.	13.	2.	24.5 ..	80.70.

Oct. 1-15	17.	15.	2.	22.9	„	82.89.
16-31	19.	10.	9.	23.3	„	86.40.
Nov. 1-15	15.	6.	9.	42.2	„	
16-30	25 obtained, all due so far have			“hatched.”		
				†† (24.7)		
Dec. 1-15	29.					†† increased by further hatching to 25.8 days.

Mr. Lloyd remarks in this connection “The table is incomplete in that it does not include the humidity of the air which has doubtless as much influence as temperature—The break in August and September is due to an attack of ants, which killed the greater number of the flies then in captivity.—Apart from this the number of female flies may be taken as constantly from 100—200. The following facts seem clear.

“As the temperature rises (and the air becomes drier) above the optimum.

1. The number of pupæ produced by a given number of females is reduced.

2. A larger proportion of these pupæ die.

3. The duration of the pupation period is reduced.

“These three factors make it difficult to decide what is the optimum temperature for the flies. I take it that the optimum would be the temperature at which the pupation period is of the longest duration without the vitality of the pupæ being reduced.”

Mr. Lloyd's deductions on this subject tend to confirm an observation made in September 1910 (i.e. shortly before the beginning of the rainy season and when the temperature is probably highest), by Dr. Leach who found when travelling near the Lukasashi River, that not one of many hundreds of female mosquitos examined was pregnant.

Gl. Fusca.

Prolonged and careful search in the localities where this was previously reported has resulted in the finding of two specimens only, both males.

LIST OF CASES OF TRYPANOSOMIASIS IN LUANGWA CLOSED AREA.

The following cases, which are continued in series from my last report have been found since the date of that report.

European.

Case No. 29. J. M. F.....diagnosed 17th
November 1910 at Mpika. Previous history, left Fort Jameson October 5th

proceeded via Chinundas and Mwailezi foot path through Choma's village on the Lundazi River where he arrived on or about 11th and on leaving which place he gave up using his bicycle and took to Machilla: on 13th complained of headache and pain in the neck, reached Mpika two or three days later.

A point worth noting in this connection is that a case of the disease found by me on my recent examination of that part of the Valley north of the Nawalia—Fort Jameson Road was at Choma's village, where apparently symptoms in the case of J. M. F. made their first appearance,

On this route Chinundas is probably the first possible area of infection; between Chinundas and Choma's is roughly 5—6 days journey, infection probably occurred at Chinundas and first demonstrated itself at Choma's.

This case ended fatally soon after his arrival in England on December 28th 1910.

Natives.

No. 30. Kapasula, adult male of Chintani's, village Luangwa River, twelve miles south of the Serenje—Fort Jameson Road.

No. 31. Seboa of Chiwangu's village, east bank of Luangwa River, south of Fort Jameson—Serenje Road.

No. 32. Lemaki of Chisenga's east bank of Luangwa. South game reserve.

No. 33. Chinangeru, elderly female of Ntinkasonyas village.

No. 34. Pondani, of Kawali's village South.

No. 35. Chempuno, of Mpande's village, elderly male.

No. 36. Chnkwangwa of Kapanizi's village.

No. 37. Towa, middle aged female wife of Kayakala of Patiko's village.

No. 38. Wala, adult male, at Petauke (Dr. Leach's cook).

No. 39. Saidi, of Karonga's village near Chntika, Hargreaves—Fort Jameson road, adult male.

No. 40. Rupia. March 29. 1911 at Chwandas, Fort Jameson—Serenje Road (one of Dr. Leach's carriers).

No. 41. Uzembe, adult male, Nachfu's village, Fort Jameson District. His wife lives at a village on the Lupandi River near the Luangwa.

No. 42.? of Kazembe's village.

No. 43. Mayembe, of Kazembe's village, male aged 30 Mpika—Fort Jameson Road.

No. 44. Chipululu, of Kazembe's village, male aged 8

No. 45. Chintu, of Mponye's village, female aged 25—30 to south of Mpika—Fort Jameson Road.

- No. 46. Steamer, of Lumbwi's village near Nawalia.
- No. 47. Chisenga, of Chintunwawa's village, (male aged 12) south of Fort Jameson—Mpika Road.
- No. 48. Kanungwi of Mupema's village, female aged 26.
- No. 49. Kafulunga, of Chirabwe's village on Luangwa about 18 miles south of Hargreaves; an old man.
- No. 50. Chabvala of Mpocha's village near Hargreaves, male aged about 20.
- No. 51. Moomba, of Mwapi's village near Hargreaves, female aged about 25.
- No. 52. Chiwala of Wimbi's village Hargreaves Petauke road, male, aged about 20.
- No. 53. Bandawe, corporal Northern Rhodesia Police aged about 30. Almost certainly contracted in neighbourhood of Hargreaves probably at Chirabwes.

Lundazi District.

- No. 54. Chipayira, of Ntumbati's village, male.
- No. 55. Waicha of Kayaza's village, female.
- No. 56. Sikoti, male of Saidi's village.
- No. 57. Cawayenda (male) Choma's village.
- No. 58. Mwawa of Mwamba's village (old man).
- No. 59. Mamarlo, of Mundala's village (male).
- No. 60. Chindoko (male) of Msolola's village.
- No. 61. Mwape, of Daroba's village (female), one of Chief Chikwa's wives.
- No. 62. Mwanadenge of Daroba's village, male.
- No. 63. Mondoka of Luchenga's village, male.
(probably contracted the infection at Daroba's village).
- No. 64. Mbulmalaya, of Mbotya's village, male.

Petauke District.

- No. 65. & 66. Found by Dr. Leach between Ndevus on the Luangwa and Petauke, details not yet received.

Three of the five cases found in Chinmdas District were in natives connected with the Mission at Kasenga, Nyasaland. There are some 40—60 of these Teachers in that locality. This incidence in natives connected with the Mission is so much greater than amongst the general population that there is probably a source of infection over the Border in Nyasaland, from where this infection has originally come.

DESTRUCTION OF GAME.

In connection with Sleeping Sickness prophylaxis game has to be regarded from two practically independent points of view, namely (1) as offering a means of subsistence to the fly (2) as reservoirs of the disease.

The bulk of the opinion in this country seems to favour the view that the larger antelope are responsible for the presence of Tsetse fly, and that their destruction would be quickly followed by the disappearance of fly. These views lack proof. There is undoubtedly a certain amount of circumstantial evidence in favour of the former, but it is I think mainly based on limited local knowledge: personal observation has convinced me that either view can be almost proved by the proper selection of local conditions. That the destruction of game would be followed by the disappearance of the fly is purely conjecture and is based for the most part on what is reported to have followed the rinderpest. Recently however the discovery that certain varieties of antelope harbour a trypanosome morphologically and in many of its animal reactions identical with the Luangwa variety of human trypanosome and which is transmissible by *Glossina Morsitans* forms in conjunction with such evidence as there is in favour of the relationships between this fly and antelope a very strong case against the latter, and should this trypanosome eventually be proved beyond a doubt to be pathogenic to human beings, and failing the removal of the fly by other means, the question of the removal of the antelope as reservoirs of disease will have to be considered.

It does not seem clear how those who urge the destruction of the antelope propose that it should be done.

Arming the natives, the encouragement of game drives on a large scale, trapping, and other such methods have been suggested.

There seems little doubt that a limited area can by means of the methods enumerated above be cleared, at least temporarily, of game: it must not be presumed however that this game has been destroyed, the greater part of it in all probability has simply migrated in search of safety. These methods deserve consideration as a means of ridding the neighbourhood of European settlements, and other habitation, (limited areas), of game and possibly of fly, the result being brought about more by migration than by destruction.

To apply it however to a large area, such as the Luangwa Valley, which is known to be infected, would be to drive the game elsewhere, in all probability on to the Muchinga Plateau and into Nyasaland, and into the fly belts occurring there which we presume are not yet infected, and which by means of regulations and strict supervision, every effort is being made and considerable money expended to keep free from infection, and which efforts would be immediately defeated by this procedure.

The time which such methods would take to provide an appreciable diminution in the amount of game must also be considered. It seems reasonable to suppose that at least ten years would elapse, even under the

conditions of an organised warfare against the game, before any marked diminution in their numbers would become apparent, and that even at the end of such time it is probable that a sufficiency for the maintenance of the fly, if such be necessary, would still remain, and the fly though possibly not so numerous, would still be in sufficient numbers to support an epidemic and produce a situation, little if anything in advance of the original.

A method which is so slow and so imperfect, and accompanied by so much danger and doubt as to its results cannot be regarded as one of practical utility or as one suited to the requirements of the present situation.

The agitations at present evidenced in many quarters for the wholesale destruction of game must be looked on as premature and as resulting from ignorance of local conditions and from an ill-conceived idea both as to its practicability and possibilities.

The practical demonstration of what may be expected to follow such efforts will be shown by the experiment which has been approved, namely the complete destruction of all game in the limited and definitely restricted fly belt in the neighbourhood of Sithitambos and Kanduzi's villages, on the Southern Border Road.

This will be carried out during the coming dry season, and accurate observations as to its results will be made until some definite opinion can be given as to its effect.

LUANGWA CLOSED AREA. PROPHYLAXIS.

Under the conditions which now obtain, namely transmission by *Glossina morsitans*, complete prevention would consist of the adoption of one of the three following methods.

1. Destruction of the fly.
2. Removal of all sources of infection, namely infected human beings and mammals.
3. Removal of the population.

No. 1. The Destruction of the Fly.

The destruction of the fly is obviously the root of all prophylaxis, and if possible the end to be attained. Its complete destruction means the elimination of the disease, as well as inestimable advantages apart from questions of health.

Unfortunately there are no means at present known by which this can be attempted with any hope of success. The question of the influence of game destruction in this connection has been discussed elsewhere. This also is a subject on which no definite knowledge is available: such measures as we have knowledge of are merely palliative and applicable only to a very limited extent.

Little is known of the binomics of this fly in nature and a study of its natural enemies, essential food, and breeding habits in addition to what disease if any it is liable will form a useful ground work for investigation.

It cannot perhaps be confidently asserted that a complete knowledge of this subject will necessarily include the knowledge of a ready means of elimination. It is however probable that an increase in the knowledge of its life and propagation will help to do so and the proposal has now been approved that as soon as the details can be arranged a staff of trained entomologists will start to work out this most important problem.

No. 2. (a) Removal of infected human beings, i.e. segregation. The question of segregation in the Luangwa closed area will have to be regarded from an entirely different point of view to elsewhere in Sleeping Sickness Administration. In dealing with human trypanosomiasis transmitted through the agency of *Glossina Palpalis*, it is a matter of comparative ease owing to the habits and restricted distribution of this species to place infected persons outside all possibility of being a danger of further infection to the fly and a source of danger to others. It is however very different in dealing with *Glossina Morsitans* as the transmitting agent, and the question of the desirability for the removal of infected persons in these areas both with a view to segregation and also to treatment has to be reconsidered.

One, if not the chief benefit to be expected from segregation is the limitation of the source of Infection. It has to be considered whether this can be expected to follow segregation under the conditions with which we are dealing. A native suffering from trypanosomiasis is moved from his village to the segregation camp which in the great majority of cases is at a considerable distance probably several days journey and mainly through fly, thus constituting a danger towards the spread of infection.

A trypanosome, identical in many respects with the Human Trypanosome, has been found by Dr. Kinghorn to be harboured by several varieties of antelope, to remove a human being suffering from trypanosomiasis, with the idea of limiting the sources of infection and at the same time to leave many other sources behind, does not seem to justify the dangers and difficulties involved in so doing.

The effect of the system of segregation on the native mind is a most important factor and one having a very great influence on its possibilities. The system is at present regarded with extreme distrust and fear: this is not unnatural as up to the present nearly all the cases so removed have terminated fatally. Consequently there is a tendency on the part of the natives to evade this treatment, and there are signs that it will become increasingly more difficult to discover cases of the disease if the result of doing so is to be segregation. Treatment has so far given no encouraging result: it cannot therefore be urged that the condition of the individual will be bettered by removal nor since by his removal the source of infection is not removed, will the condition of the community be appreciably improved.

The possibility of removal while trypanosomes are temporarily absent from the peripheral circulation as the result of treatment must be considered. This, if practical, would obviate the danger of the spread of infection from the patient en route but would not in any way meet the difficulties arising from the natives, fear and distrust of segregation and would require for its effective working such a great increase in staff and expenditure that its possible advantages are more than counter-balanced by its known disadvantages.

Since therefore segregation is neither an advantage to the individual or the community but rather a source of danger it is recommended that for the present except in the neighbourhood of stations and in connection with the amalgamation and removal of villages, where it is practicable and effective, it be discontinued to be regarded as an essential in prophylaxis.

3. REMOVAL OF THE POPULATION.

To depopulate the Luangwa closed area containing probably 120,000 people may I think be taken as an impossibility, the natural difficulties are enormous, the population would immediately become antagonistic, the staff required for the work would be immense, and an increased mortality from the disease, and several years famine would be the almost inevitable results.

The method which I now suggest for your Honour's consideration is a modification of 2 and 3, and roughly consists of the amalgamation and removal of the more conveniently placed villages to a suitable fly free area, where centralisation could be effected in the treatment of disease and also in the necessary supervision required to ensure no return to dangerous areas. A movement of this sort will be to some extent limited in its applicability and must necessarily be gradual. The selection of suitable sites, the preparation of gardens and provision for food supplies will take a considerable time. In addition to this it is further recommended for the whole area that :

1. Natives in fly areas should be prohibited from keeping domestic animals goats, sheep, dogs, &c.

2. That they should be encouraged by means of trapping, pits, drives, and if possible in being allowed a certain number of firearms, to clear the vicinity of all villages in fly country of game, and that except in the vicinity of villages game should be as far as possible unmolested in order to prevent their movement into areas free of infection.

3. That natives should be encouraged to protect all cultivated lands, by means of cuttings or clearings from fire, with the object of allowing a more complete clearance to be made by means of grass fires. At present in many places the native is reluctant to start a grass fire owing to the danger of losing his crops thereby.

4. That the headman of each village should be encouraged by means of small payments, to rid as far as possible the immediate vicinity of his

village of fly by means of mechanical appliances for trapping, &c. The details of this work might be under the supervision of the Medical Officer of the district.

5. That certain routes, to the exclusion of all others, should be used for all natives and others travelling through these areas, and that these routes should as far possible be rendered safe both by the removal of infected cases and by the encouragement of game destruction in their vicinity.

CONGO BELGE.—INTRODUCTION OF GL. PALPALIS BY MEANS OF RAILWAY COMMUNICATION.

The question of the possibility of the introduction of *Glossina Palpalis* into this territory from the infested areas of the Katanga by means of Railway communication was discussed at a Conference held in January 1911, under the auspices of the Foreign Office and certain preventive measures were then recommended.

In this connection and in view of the extension of Railway construction from Elisabethville to Kambove, and also in view of the fact that the greater part of the labour for this work was drawn from Northern Rhodesia, an examination of the route was made during August by Mr. W. H. Jollyman, on behalf of this Administration in which work Messrs. Pauling and Company very kindly assisted.

Glossina Palpalis was not found at any point on the proposed route.

The Lufira River was reported on as presenting suitable conditions for carrying *Glossina Palpalis*. The nearest point however at which this species was found was in the neighbourhood of the Kiru Mission some 40 miles down stream from the site of the proposed Railway crossing. The Missionaries stationed there state that as yet no Sleeping Sickness has appeared in the Mission villages.

It is therefore evident that until this Railway be continued northwards beyond Kambove there is no danger of the introduction of *Glossina Palpalis* to this territory by these means.

Glossina Morsitans was found in more or less abundance throughout the entire route.

It has been reported that the majority of the Capitaos employed by rubber traders in that part of the Katanga which lies to the north of the mining areas are probably Rhodesian Natives. As these natives are sent out to collect rubber or labour, in districts where Sleeping Sickness is endemic, it is recommended that the Belgian authorities be again approached with the object of inducing them to take some measures for the safety of Rhodesian natives employed in their territory and consequently for the safety of Rhodesia.

THE UNAUTHORISED CROSSING OF THE LUAPULA THROUGH GL. PALPALIS.

A considerable number of Luapula natives still cross into Belgian Territory in search of work, thereby running very great risks of infection. They seem to be mainly employed by small employers of labour. If the Belgian Authorities could be induced by some system of registration or some form of control to prohibit this it would greatly aid in the suppression of the disease.

THE OCCURRENCE OF THE LUANGWA VARIETY OF HUMAN TRYPANOSOME OUTSIDE THE CONFINES OF THE PRESENT CLOSED AREA.

The question of whether the Luangwa Valley human trypanosome has a distribution beyond the confines of the present closed area will mainly depend for settlement on whether or not the *Glossina Morsitans* will be found to act as the vector under the different climatic conditions which obtain on the Plateau and elsewhere. It has been suggested that this will not be found to be so. However judging from the fact that we know the disease to be transmissible in Chiumdas country, the altitude of which is roughly 3500 feet as compared to the Luangwa Valley 2200-2500, there seems unfortunately little reason to hope that transmission will be in any way inhibited by the natural conditions which exist throughout the rest of the territory. The Sleeping Sickness Commission have now started investigations near Mpika for the settlement of this question, and it is hoped that a definite result will be available during the next few months.

In the meantime the two following cases are of special interest in this connection.

1. The case of European, whose previous history quite excluded the possibility of his having contracted the disease in the Luangwa endemic area, or Nyasaland. There was a previous history of residence in endemic areas in the Congo Free State, but judging from the subsequent development of the case and to the somewhat remote period at which this could have occurred through the agency of *Glossina Palpalis*, it seems probable that this infection was contracted by other means, i.e. *Glossina Morsitans*, and in a section of country about which there had previously been no suspicion of the possibility of trypanosome infection. This view is strengthened by the fact that subsequent investigations have demonstrated the presence of posterior nucleation, the specific characteristic of *T. Rhodesiense*, in the infecting trypanosome. (This case has been fully reported by Dr. G. W. Ellacombe in the *Journal of Tropical Medicine and Hygiene*).

2. The Second case was diagnosed by Dr. P. H. Ward at Ndola in August 1911, there is no knowledge available as to the nature of the infecting trypanosome but a complete history of the native's previous movements has been obtained from Messrs. Moffat Thomson and Sandford, and there seems no reason to attribute the infection to *Glossina Palpalis*.

So far all search for further cases in the localities in which these infections might have taken place has proved negative.

